

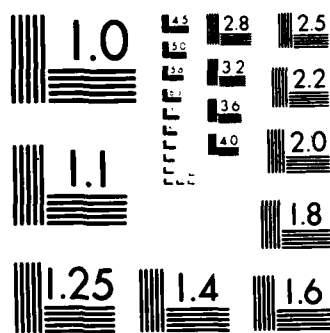
NO-A106 838 QUARTERLY R&D SUMMARY(U) AIR FORCE HUMAN RESOURCES LAB 1/1
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**HUMAN
RESOURCES**

QUARTERLY R&D SUMMARY
JULY - SEPTEMBER 1987

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Edited by

Esther M. Barlow

TECHNICAL SERVICES DIVISION
Air Force Human Resources Laboratory
Brooks Air Force Base, Texas 78235-5601

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LABORATORY

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5601

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PREFACE

This document contains a summary of each Air Force Human Resources Laboratory Technical Report and Technical Paper that the Human Systems Division Public Affairs Office has approved for public release during the past 3 months.~ It does not include summaries of Special Reports, nor Technical Reports and Technical Papers not cleared for public distribution.

In addition, the unlimited distribution technical documents published during this quarter are listed. All are available from the Defense Technical Information Center, Cameron Station, Alexandria, Virginia 22314, to qualified requesters and from the National Technical Information Service, Springfield, Virginia 22151. The AD number should be included on requests for documents.



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SUMMARIES

Mumford, M.D., Harding, F.D., Fleishman, E.A., & Weeks, J.L. An empirical system for assessing the impact of aptitude requirement adjustments on Air Force initial skills training, (AFHRL-TR-86-19). Brooks AFB, TX: Manpower and Personnel Division.

The objective of this research and development (R&D) effort was to develop and validate an empirical procedure for predicting training outcomes associated with initial-skills courses administered by the United States Air Force Air Training Command. The R&D consisted of the collection and analysis of information to determine the effects of student attributes and course properties on training outcomes such as academic training performance and student elimination. The value of the procedure resides in its use as a decision support system for personnel and training management. It can be applied on a course-by-course basis to evaluate "what-if" questions concerning the effects of changes in student and course characteristics on training outcomes. For example, the system could be used by personnel managers to forecast the training outcomes likely to result from decreases in the minimum aptitude test score required for entry into an initial-skills course. It could be used by training managers to forecast the training outcomes likely to result from increases or decreases in the trained personnel requirement for the course. It could be used by course designers to forecast the training outcomes likely to result from adjustments in course length or student/instructor ratio. In addition to providing a means of forecasting training outcomes associated with changes in single variables, it could be used to forecast training outcomes associated with simultaneous adjustments in several student and course characteristics. The payoff of this R&D is a decision support system for personnel and training management that can be applied to anticipate and avoid adverse training outcomes.

Drasgow, F., Levine, M.V., McLaughlin, M.E., & Earles, J.A. Appropriateness measurement, (AFHRL-TP-87-6, AD-A184 185). Brooks AFB, TX: Manpower and Personnel Division.

The military services have a vital concern in assuring that aptitude test scores are appropriate measures of examinees' true abilities. Substantial bonuses have been paid to examinees with sufficiently high scores as enticement to enlist into selected occupations. Under mobilization, exemption from service will be given to examinees with unacceptably low scores. Therefore, cheating to improve scores and deliberately picking incorrect answers to lower scores are both plausible threats to the integrity of enlistment testing. The goal of Appropriateness Measurement is to develop ways to analyze examinees' responses to multiple-choice tests so as to identify such inappropriate test responding.

This effort evaluates 11 practical appropriateness indices. Three, which are based on modern test theory (Item Response Theory), were found to effectively detect aberrant response patterns across a fairly wide range of conditions. This success was obtained when the test had many items but was substantially lessened for military selection test lengths. However, methods developed for combining information on aberrant responding across several different tests resulted in an effectiveness comparable to that found with the longer tests.

The results strongly suggest that appropriateness indices can be used effectively in operational settings. Further research is suggested on a class of indices called "optimal" which hold the promise of even better identification of aberrant responding than those indices already identified.

Hedge, J.W., & Lipscomb, M.S. Walk-through performance testing: An innovative approach to work sample testing (AFHRL-TP-87-8). Brooks AFB, TX: Training Systems Division.

As part of an extensive job performance measurement research and development program, the Air Force Human Resources Laboratory has developed a new methodology called Walk-Through Performance Testing (WTPT). WTPT is a task-level job performance measurement system which combines hands-on testing and interview testing to provide a high-fidelity measure of an individual's technical job competency. This document contains a series of papers, originally presented at the 92nd Convention of the American Psychological Association, which outline: (a) the conceptual frame-of-reference within which the original planning for WTPT took place, (b) the WTPT methodology and the rationale and overall approach to hands-on and interview test development, (c) the sampling strategy used to select tasks for work sample development, and (d) the approach used to analyze selected tasks for WTPT development. A final section discusses the implications of the measurement strategy.

Kavanagh, M.J., Borman, W.C., Hedge, J.W., & Gould, R.B. Job performance measurement in the military: A classification scheme, literature review, and directions for research (AFHRL-TR-87-15). Brooks AFB, TX: Training Systems Division.

The job performance measurement literature indicates that previous research relied heavily on broad-based generic indices, performance ratings, or operational measures with their inherent problems of inflation and halo effects. These broad measures were unable to take into account task-level-specific influences such as training differences or opportunities to perform; hence, such efforts have been largely unsuccessful. However, it appears that current interest, resources, and state-of-the-art technology developments have now significantly increased the probability of developing successful measures of job performance. This report describes the Air Force Human Resources Laboratory's (AFHRL) research program for development of individual job performance measures. The report describes the construction of a job performance measurement classification scheme into which the relevant empirical and theoretical literature are organized. Based on this framework, specific recommendations for both applications and research directions are given.

Brandt, C.M., Jernigan, J.H., & Dierker, R.J. Integrated Maintenance Information System: Training technology scenarios, (AFHRL-TP-87-18). Wright-Patterson AFB, OH: Logistics and Human Factors Division.

The Air Force Human Resources Laboratory (AFHRL) is developing an Integrated Maintenance Information System (IMIS). IMIS will demonstrate the capability to access and integrate information from multiple sources and present the information to technicians through a rugged, hand-held computer. Results of the program will form the basis of requirement specifications for such a system.

AFHRL is performing preliminary research in many areas key to the success of the IMIS concept. These areas include digital authoring and presentation of maintenance instructions, integrated diagnostics aiding, human-computer interaction, advanced portable computer hardware technologies, and potential training applications. IMIS will be the culmination of a complex and thorough research and development effort. Specifications developed by the project will be validated through field tests performed by Air Force maintenance technicians. As a result, IMIS will improve the capabilities of maintenance organizations to effectively utilize available manpower and resources to meet combat sortie generation requirements.

In the work being reported, representative base-level maintenance training requirements were identified. Based on these requirements, a series of "operational scenarios" were developed to help conceptualize how IMIS technology might be used to support base-level maintenance training. Based on this work, it appears that IMIS can improve upon present methods used to provide this training.

Stoker, P., Hunter, D.R., Batchelor, C.L., & Curran, L.T. Air traffic controller trainee selection (AFHRL-TP-87-19). Brooks AFB, TX: Manpower and Personnel Division.

The objective of this effort was the development of an improved method for the selection of first-term personnel for entry into air traffic controller training.

Rising attrition levels during both training and initial assignments led the Air Force Communications Command to issue a Request for Personnel Research to reevaluate existing selection measures and develop new measures, if needed. At that time, the General Aptitude Index (AI) and Administrative AI from the Armed Services Vocational Aptitude Battery (ASVAB) were used for selection.

First, the relationships between ASVAB AIs and training performance were assessed. In several independent samples, with a total of over 3,000 subjects, it was found that the General AI, Mechanical AI, and Electronics AI correlated well with training performance, whereas the Administrative AI had a smaller relationship with the criteria. On the basis of these analyses, the Air Force Human Resources Laboratory recommended the deletion of the Administrative AI as a selector for entry into air traffic controller training. That recommendation was accepted and the use of the Administrative AI was discontinued.

In addition, five tests were selected for experimental validation: (a) Multiplex Controller Aptitude Test (MCAT), (b) Object Completion Test (OCT), (c) Rotated Blocks Test (RBT), (d) Perceptual Abilities Test (PAT), and (e) Electrical Maze Test (EMT). These five tests were administered to 457 air traffic controller candidates prior to the start of training. Test scores were compared to a dichotomous training criterion--pass versus failure in training. All tests, except the PAT, were significantly correlated with the pass versus fail criterion. The MCAT was the best single predictor. Multiple regression analyses showed that the combination of MCAT and RBT yielded the best combined prediction, and that their use would improve upon prediction made by using the ASVAB alone.

When evaluated against first-year job success/attrition, the AIs were not found to relate significantly to this criterion; only the PAT related significantly to the criterion.

Carretta, T.R. Basic Attributes Test (BAT) system: A preliminary evaluation (AFHRL-TP-87-20). Brooks AFB, TX: Manpower and Personnel Division.

High rates of attrition among students in Undergraduate Pilot Training (UPT) are a major concern for the Air Force. Recent research and development efforts at the Air Force Human Resources Laboratory have attempted to reduce attrition rates by improving the method by which pilot candidates are selected. Currently, UPT students are chosen primarily on the basis of their scores on the Pilot composite of the Air Force Officer Qualifying Test (AFOQT). The present effort sought to determine the extent to which scores on three cognitive/perceptual subtests from an experimental test battery, known as the Basic Attributes Test (BAT), added to the validity provided by the AFOQT Pilot composite score.

Scores from the three cognitive/perceptual tests--Digit Memory (information input efficiency), Decision-Making Speed (choice reaction time), and Item Recognition (short-term memory storage, search and comparison operations)--did not add significantly to the prediction of graduation or failure. However, the experimental subtests did demonstrate significant relationships with several other performance measures including recommendations for fighter or non-fighter assignments following UPT.

Polzella, D.C., Hubbard, D.C., Brown, J.E., & McLean, H.C. Aircrew training devices: Utility and utilization of advanced instructional features, (Phase IV - Summary report) (AFHRL-TR-87-21). Williams AFB, AZ: Operations Training Division.

Modern Aircrew Training Devices (ATDs) are equipped with sophisticated hardware and software capabilities, known as Advanced Instructional Features (AIFs), that permit a simulator instructor (SI) to prepare briefings, manage training, vary task difficulty/fidelity, monitor performance, and provide feedback for flight simulation training missions. The utility and utilization of the AIF capabilities of USAF ATDs was explored by means of a survey of 534 SIs from Air Training Command, Military Airlift Command, Strategic Air Command, and Tactical Air Command training sites. The primary purpose of the survey was to provide a database that could be used in defining the requirements for ATD procurements and in developing future ATD training programs. In general, the features that were rated highest were those used for training management, variation of task difficulty/fidelity, and monitoring student performance. The level of AIF use was affected somewhat by hardware and/or software unreliability, implementation time, functional limitations, and design deficiencies. However, the presumed training value of an AIF was the most important determinant of its use. Recommendations are made concerning the AIF capabilities of future ATDs and research aimed at determining the principles of effective AIF use.

Cheal, M., Lyon, D., & Hubbard, D.C. Visual attention effects on discrimination of line orientation and line arrangement (AFHRL-TR-87-22). Williams AFB, AZ: Operations Training Division.

In looking at characters on a page, some characters seem to "pop out." One example is a slanted line among a group of vertical lines. It has been assumed that this phenomenon occurs because the response to such stimuli is automatic or preattentive. If this is true, does focal attention have an effect on discrimination of such stimuli? In the first experiment, attention was directed to characters in peripheral vision while the eyes remained stationary. It was found that discrimination of the direction of a slanted line was minimally facilitated by time to shift attention to the target, whereas discrimination of the direction of a target composed of two line segments (a sideways T) required time to shift and focus attention and benefited from longer periods that allowed attention to accumulate at the target. In a second experiment, it was shown that accuracy was much poorer if attention was misdirected to a nontarget area, for both discrimination of slanted lines and discrimination of Ts. Differences in the effect of attention on discrimination of the two types of stimuli may occur because only discrimination of Ts requires focus of attention on the target. On the other hand, both SLANTs and Ts may be affected by removal of attention from an incorrectly cued location.

Collins, D.L., Hernandez, J.M., Ruck, H.W., Vaughan, D.S., Mitchell, J.L., & Rueter, F.H. Training Decisions System: Overview, design, and data requirements, (AFHRL-TP-87-25). Brooks AFB, TX: Training Systems Division.

The Training Decisions System (TDS) is being developed to provide a more unified and integrated approach to training programming and planning. Specifically, TDS uses information obtained from job tasks performed by airmen, combined with airman assignment information and Air Force training capacities, to determine what cost-effective training options are available.

Recent Air Force budgetary constraints have resulted in a reduced supply of money and personnel for accomplishing Air Force training. Consequently, training decisions in the Air Force are becoming increasingly critical. Furthermore, making those decisions has been made more complex by incomplete and inadequate cost data. Due to the scope and complexity of Air Force training, the challenge has been in deciding what to train (training content), where to train (appropriate training settings), and when training should occur (at what point in an airman's career). The resulting decisions, although the best possible given the information available at the time, could have benefited from a large, accurate data base to help answer these questions.

TDS is an extensive multi-year research and development effort consisting of three basic subsystems and a fourth integrating subsystem. The first subsystem, the Task Characteristics Subsystem, will provide task training modules and associated training site allocation preference data. These modules will be the prime building blocks for the other subsystems. The second subsystem, the Field Utilization Subsystem, will provide present and alternative training/personnel assignment patterns and associated preference values. These training/personnel assignment patterns will be the prime focus of analysis for the TDS. The third subsystem, the Resource/Cost Subsystem, will provide costs and capacity indicators for each task module for each training site. These costs and capacity functions will be an important input to the training optimization routines contained in the Integration and Optimization Subsystem. This subsystem will result in the integration of the three previously described subsystems. In addition, it will provide optimization software and an interactive system that will allow managers to answer "what if" questions relative to training.

Geri, G.A., & Hubbard, D.C. Visual contrast sensitivity functions: A comparison of two psychophysical procedures using untrained observers, (AFHRL-TR-87-26). Williams AFB, AZ: Operations Training Division.

The contrast sensitivity function (CSF) is rapidly replacing tests of simple visual acuity as a criterion for establishing visual capability. It has been shown, for instance, that individuals with the same visual acuity may have drastically different CSFs, and that those differences may predict differences in performance on various visual tasks. The criteria for deciding among the techniques available for obtaining CSFs is usually some measure of efficiency or statistical variability. There have been relatively few attempts, however, at establishing practical criteria relevant to a given task. The present experiment is concerned with obtaining valid CSFs from untrained observers. Practical considerations dictated that the testing should last no longer than 30 minutes and that the procedures should be simple enough for untrained observers to perform. Toward this end, two standard psychophysical procedures were evaluated: a tracking method in which stimulus onset was gradual and a "yes-no" staircase method in which the stimulus was flashed for 0.25 second. Both procedures resulted in repeatable CSFs across days; but the tracking procedure could be performed in less time and was subjectively easier, as determined by the observers tested. No statistically significant differences were found between the two procedures.

Lyon, D.R. How quickly can attention affect form perception? (AFHRL-TR-87-28). Williams AFB, AZ: Operations Training Division.

This research examines the phenomenon of internal attention shifting; that is, paying attention to different places in the visual field without changing the direction that the eyes are pointing. Recently, some researchers have suggested that sequences of internal attention shifts may be a necessary part of visual perception. This seems to require that attention be shifted very rapidly, since a complex scene can often be seen with only brief presentation. The purpose of the experiments in this report was to find out how fast such attention shifts are. The results indicated that it is possible to shift attention from one visual location to another in less than 68 milliseconds, but that vision continues to improve for 120-150 milliseconds after a cue to shift attention. Furthermore, it was shown that attention increases the rate at which information is extracted from a stimulus. Thus, internal attention shifts are fast enough to be used in normal visual perception. They may also be a component of skilled performance in vision-dependent tasks.

Stephenson, R.W., & Gentner, F.C. Manpower, personnel, training, and safety guidance and control for weapon system acquisitions, (AFHRL-TP-87-31). Brooks AFB, TX: Special Projects Office.

The need for manpower, personnel, training, and safety (MPT&S) guidelines and constraints can originate at both the specific weapon system and aggregate system levels--whereas the typical Government acquisition team specializes only in information at the first (weapon system design) level. The amount of organizational support provided them is also not adequate to their task. In order to help integrate MPT&S factors during weapon system acquisitions, the Government needs: (a) enhanced analytic capabilities to analyze total system tradeoffs between man and machine in the performance, maintenance, and support of system tasks; (b) interactive communications with experts in system utilization policy and aggregate system constraints; (c) MPT&S-oriented incentive systems for Government, as well as for contractor personnel; and (d) a strong centralized headquarters advocate for MPT&S factors with the authority to establish policies and procedures for acceptable MPT&S guidance and control. Specific control guidance is also needed by Government acquisition teams and teams of contractor personnel. For this purpose, recent case studies of Government guidance and control were analyzed, and two lists of "do's" and "don'ts" were developed.

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